CLAIMS

That which is claimed is:

1. A polymerization process comprising:

feeding a feed material comprising at least one olefin monomer to a loop reaction zone;

polymerizing, in the loop reaction zone, the olefin monomer to produce a fluid slurry comprising solid olefin polymer particles;

continuously withdrawing a portion of the fluid slurry through a plurality of active slurry withdrawal lines;

monitoring the pressure in the active slurry withdrawal lines; and

opening an inactive slurry withdrawal line in response to the monitored pressure in one of the active slurry withdrawal lines.

2. A process according to claim 1, further comprising flushing diluent through the inactive slurry withdrawal line prior to opening.

3. A process according to claim 2, further comprising automatically activating the inactive slurry withdrawal line when one of the active slurry withdrawal lines is at least partially plugged.

4. A process according to claim 3, further comprising:

rendering the inactive slurry withdrawal line active within 1 minute of detecting the plugging.

5. A process according to claim 1 wherein the active and inactive slurry withdrawal lines are the exclusive means for withdrawing product slurry from the loop reaction zone.

6. A process for operating a loop polymerization reactor, the process comprising:

feeding at least one olefin monomer and diluent to the reactor;

feeding a polymerization catalyst to the reactor;

circulating a fluid slurry comprising unreacted ethylene and solid polyethylene particles in the diluent through the reactor;

continuously withdrawing a portion of the fluid slurry through a plurality of active continuous take offs; and

continuously flushing diluent through an inactive continuous take off.

7. A process according to claim 6 further comprising activating the inactive continuous take off when at least one of the active continuous take offs is at least partially plugged.

8. A process according to claim 7 further comprising:

activating the inactive continuous take off within 1 minute of detecting the plugging.

9. A process according to claim 6 wherein the active and inactive continuous take offs are the only take offs for product slurry from the loop reaction zone.

10. A process for starting a loop polymerization reactor, the process comprising:

feeding ethylene to the reactor; and

feeding isobutane to the reactor;

wherein the mass ratio of ethylene to isobutane fed to the reactor is sufficiently low to avoid plugging of a continuous take off.

11. A process according to claim 10 wherein the mass ratio is 1:1 or lower.

12. A process according to claim 10 wherein the mass ratio is 4:5 or lower.

13. A process according to claim 10 wherein the mass ratio is 2:3 or lower.

14. A loop reactor apparatus comprising:

a plurality of major segments;

a plurality of minor segments, each minor segment connecting two of the major segments to each other, whereby the segments comprise a continuous flow path;

at least one monomer feed fluidly attached to the continuous flow path;

at least one catalyst feed fluidly attached to the continuous flow path; and

at least two active continuous take offs each attached to the continuous flow path, and each of the continuous take offs comprises:

a slurry withdrawal line in open communication with the reactor; and

a take off valve disposed along the slurry withdrawal line for regulating flow of the slurry through the slurry withdrawal line;

at least one inactive continuous take off attached to the continuous flow path, the continuous take off comprising:

a slurry withdrawal line in open communication with the reactor; and

a take off valve disposed along the slurry withdrawal line for regulating flow of the slurry through the slurry withdrawal line.

15. A loop reactor apparatus according to claim 14 wherein the inactive continuous take off further comprises a flush line fluidly connected to provide diluent to the slurry withdrawal line.

16. A loop reactor apparatus according to claim 14 wherein the take off valves V-ball valves having a nominal body size of at least $1\ ^{1}/_{2}$ inch.

17. A loop reactor apparatus according to claim 16 wherein the continuous take offs further comprise a block valve disposed along the slurry withdrawal line upstream of the V-ball valve and downstream of the continuous flow path.

18. A loop reactor apparatus according to claim 14 further comprising;

a monomer pressure transmitter disposed on the monomer feed; and

a controller that is configured to receive an input signal from the monomer pressure transmitter, and the controller is configured to send an output signal to adjust at least one of the continuous take offs.

19. A loop reactor apparatus according to claim 18, further comprising:

a pressure transmitter disposed on the slurry withdrawal line downstream of the take off valve and operatively connected to provide a signal to the controller; and

wherein the take off valve is automatically controlled by the controller, which adjusts the take off valve in response to one or more input signals from the pressure transmitters on the monomer feed and the slurry withdrawal line.

20. A loop reactor apparatus according to claim 14 wherein the slurry withdrawal line narrows before the take off valve and widens after the slurry withdrawal line.

21. A loop reactor apparatus according to claim 14 wherein the continuous flow path has a volume of greater than 30,000 gallons.

22. A loop reactor apparatus according to claim 14 wherein the continuous flow path has a volume of greater than 35,000 gallons.

23. A loop reactor apparatus according to claim 14 wherein at least two active continuous take offs and at least one inactive continuous take offs are disposed on one of the minor segments.

24. A loop reactor apparatus according to claim 14 comprising at least four of the continuous take offs.

25. A loop reactor apparatus according to claim 14 wherein the continuous flow path is essentially free of horizontal flow paths.

26. A loop reactor apparatus according to claim 14 wherein the minor segments are continual curves defining a portion of a circle, and the circle has a radius of at least 3 feet.

27. A loop reactor apparatus according to claim 14 wherein the major segments are substantially horizontal.

28. A loop reactor apparatus according to claim 27 wherein the minor segments are substantially horizontal.

29. A loop reactor apparatus comprising:

a pipe loop reactor adapted for conducting an olefin polymerization process comprising polymerizing at least one olefin monomer in a liquid diluent to produce a fluid slurry comprising solid olefin polymer particles in the liquid diluent, the pipe loop reactor having a volume of greater than 30,000 gallons;

a plurality of elongated hollow appendages in direct fluid communication with the pipe loop reactor adapted for continuous removal of a portion of the fluid slurry from the pipe loop reactor;

a feed for introducing an olefin monomer and diluent into the pipe loop reactor;

a feed for introducing a polymerization catalyst into the pipe loop reactor; and

a circulator for circulating the fluid slurry through the pipe loop reactor.

30. A loop reactor apparatus according to claim 29, further comprising:

a pressure transmitter in fluid communication with at least one of the elongated hollow appendages; and

a controller that is configured to receive an input signal from the pressure transmitter and the controller is configured to send an output signal to adjust the flow of fluid slurry through the elongated hollow appendage.

31. A loop reactor apparatus according to claim 29, further comprising:

a pressure transmitter in fluid communication with the olefin monomer feed; and

a controller that is configured to receive an input signal from the pressure transmitter and the controller is configured to send an output signal to adjust the flow of fluid slurry through the elongated hollow appendage.

32. A loop reactor apparatus according to claim 29 comprising from four to twelve elongated hollow appendages.

33. A loop reactor apparatus according to claim 29 wherein the pipe loop reactor is essentially horizontal, and the elongated hollow appendages are attached to substantially horizontal segments of the pipe loop reactor.

34. A loop reactor apparatus according to claim 29, further comprising at least one inactive elongated hollow appendage having a flush line connected, and the flush line is adapted to continuously flush diluent through the inactive elongated hollow appendage.

35. A loop reactor apparatus according to claim 29, further comprising a controller for opening an inactive elongated hollow appendage when an active elongated hollow appendage is plugged.

36. A continuous take off mechanism for a loop polymerization reactor, the mechanism comprising:

(1) a slurry withdrawal line in fluid communication with the reactor;

(2) a take off valve disposed along the slurry withdrawal line for regulating flow of the slurry through the slurry withdrawal line;

(3) a flush line fluidly connected to provide diluent to the slurry withdrawal line; and

(4) a controller configured to receive an input signal from at least one pressure transmitter disposed on a monomer feed, and the controller is configured to send an output signal to adjust the take off valve.

37. A continuous take off mechanism according to claim 36, further comprising:

(5) a block valve disposed along the slurry withdrawal line upstream of the take off valve.

38. A continuous take off mechanism according to claim 36 wherein the slurry withdrawal line has a reduced diameter leading to and from the take off valve.